

Maricopa Association of Governments (MAG) Regional Freeway Bottleneck Study

Work Plan

The purpose of this section is to outline the major tasks required to be performed by the CONSULTANT in order to produce the needed analyses and deliverables to MAG.

A number of working papers will be submitted to document the task results of the study. An administrative draft of each working paper will be submitted in both electronic and hard copy formats to the MAG Contract Manager for review. Comments received from the MAG Contract Manager will be incorporated into the working paper prior to distribution to the Steering Committee. Nine hard copies and an electronic version of each working paper will be submitted. Comments received from the Steering Committee will be discussed with MAG staff before being incorporated into the final working paper. The working papers will be consolidated into a draft final report.

All working papers and presentation materials will be provided in Microsoft Office Suite 2000. All tables, sketches, and plots will be in both electronic format and hard copy. All spatial data will be prepared in an ArcView-compatible format.

The study area includes a total of 176 miles of these urban freeways: I-10, I-17, US 60, SR 51, SR 101, SR 143, and SR 202. The outermost limits of the study area are I-17 at the New River Road TI on the north, US 60 at Mountain View Road on the east, I-10 at Riggs Road on the south, and I-10 at SR 85 on the west.

Task 1. Administer Work Program and Management Plan

During contract negotiations, the consultant will meet with the MAG Contract Manager to review the Work Plan presented in our proposal and to identify any revisions and clarifications that may be necessary. The revised Work Plan will be included in the contract.

Task 1.1. Management Plan

Within ten days of receiving notice to proceed, the consultant will develop a detailed plan for the management of the project. The Management Plan will identify, for each task and subtask, specific work elements, schedules, personnel assignments, costs, milestones, and quality control measures. The Management Plan will also specifically describe how activities will be coordinated with the MAG Contract Manager. The Management Plan will be subject to approval by MAG and will constitute the first project deliverable.

Task 1.2. Project Administration

During the course of the project, a monthly progress report and invoice will be prepared and submitted to the MAG Contract Manager. The progress report will include a comprehensive narrative of the activities performed during the month, an estimated

percent completion for each project task, monthly and cumulative costs by task, activities of subconsultants, payments to subconsultants, a discussion of any notable issues or problems, and a discussion of activities anticipated during the next month.

In addition, each month Olsson Associates will prepare a paragraph of information regarding the study and its current status that is suitable for publication in a public newsletter and submit it with the invoice.

Task 1.3. Project Meetings

During the study, the OA team will attend and conduct Steering Committee Meetings as appropriate. Nine Steering Committee meetings are anticipated over the twelve-month duration of the study. Table 1 provides a list of meeting topics and an approximate schedule for the meetings. Steering Committee members will include MAG, ADOT, and representatives from MAG member agencies. Olsson Associates will also present the results of the study to an ADOT State Transportation Board meeting, a MAG Management Committee meeting, and a MAG Regional Council meeting.

TABLE 1. STEERING COMMITTEE MEETING TOPICS/SCHEDULE

| Week | Topics |
|-------------|--|
| 2 | Scope, Data, Ranking Factors |
| 7 | Initial Ranking Process |
| 12 | Ranking Process, Existing Data WP |
| 16 | Ranking Process WP, Data Collection Plan |
| 28 | Traffic Data WP, Problem Areas Identification, Analysis Method |
| 34 | Bottleneck Analysis WP, Proposed Improvements |
| 39 | Proposed Improvements WP, Improvement Benefits WP |
| 44 | Priority Ranking and Cost/Benefits Rating WP |
| 49 | Draft Report |

Task 1.4. Task 1 Deliverables

The Project Management Plan, monthly progress reports, and meeting minutes will be submitted as products of this task.

Task 2. Assemble Available Data

Task 2.1. Previous Studies

The purpose of this task is to collect and document all available information regarding the regional freeway system. Olsson Associates will review and document the results of all recent studies/projects conducted by MAG, ADOT, and MAG member agencies of the freeway system in the MAG area. With assistance from the Steering Committee, Olsson Associates will identify and obtain copies of all relevant reports, including:

- SR 51 HOV Lanes from 1-10 to Shea Blvd
- Traffic Interchange Improvement Prioritization Study
- Phoenix/Tucson Corridor Analysis

- I-17 Study
- US 60 Design-Build Project: I-10 to Power Road
- Value Lane Study
- Park-and-Ride Lot Study
- Grand Avenue Major Investment Study
- ADOT Interchange studies
- MAG Long Range Transportation Plan
- MAG Transportation Improvement Program
- Traffic Analysis Reports prepared for freeway design and construction projects

A summary of the recommended improvements will be prepared and will include:

- Status of recommended projects
- Responsible agency(s)
- Purpose of project
- Benefits of project
- Cost of project
- Implementation status including funding sources

Task 2.2. Traffic Count Data

The purpose of this task is to research ADOT Planning Division and Freeway Management System (FMS) data to collect all available traffic counts on the regional freeway system. Vehicle and classification counts will be assembled and documented for the freeway mainline, HOV lanes, on- and off-ramps, and freeway-to-freeway ramps.

Task 2.3. Task 2 Deliverable

The Existing Data Working Paper documenting all relevant previous studies and traffic count data discovered in this task will be prepared and submitted through MAG to the Steering Committee for review and comment following the process outlined at the beginning of the Work Plan.

Task 3. Determine Evaluation Process

Task 3.1. Develop Ranking Process

At the initial meeting of the Steering Committee, a discussion of factors, which are important and should be included in an evaluation process, will be held. Following the meeting, Committee members will be asked to score the factors by level of importance and return the scoring to Olsson Associates. The scores of all Committee members will be compiled and an initial draft ranking process using the highest ranked evaluation factors will be prepared.

An initial list of factors for consideration in developing the ranking process would include:

- Traffic volume

- Traffic density
- Crash history
- Duration of congestion
- Vehicle hours of delay
- Off-ramp back-up onto freeway mainline lanes
- On-ramp back-up onto arterial streets
- Commercial vehicle usage
- Freeway to freeway ramp queuing and weaving

The draft ranking process will be discussed at the second Committee meeting, refined as necessary, and a test case using available or estimated data will be run. The test case results will be discussed with the Steering Committee and the process will be refined and re-tested as necessary.

The primary goal of this task will be to have Steering Committee approval of the ranking process before data collection begins in September to confirm that all data that is necessary to complete the evaluation will be collected.

Task 3.2. Prepare Data Collection Plan

Based upon the existing data collected in Task 2, and the ranking methodology developed in Task 3.1, a data collection plan will be prepared. This plan will include aerial photography, video, and manual traffic counting techniques (including tube counts).

Traffic density will be determined through aerial photography. In most cases, densities are calculated across all normal travel lanes. However, in the case of freeway-to-freeway ramps, HOV lanes, or specially-designated weaving zones, counts will be made of single lanes. These special groups are treated as if they are entirely separate facilities. The RFP identified four weaving areas for special consideration:

- Loop 202, east of the SR 51 /Loop 202 /I-10 interchange
- I-10 from Baseline Road to 40th Street
- SR 51 /Loop 202 /I-10 interchange to the I-10/I-17 interchange
- Loop 202 from SR 143 to the Loop 101/Loop 202 TI.

Based upon a review of available data and studies, this list will be reviewed and locations where special handling of volume analysis is required will be determined.

Task 3.3. Work Plan Refinement

At the conclusion of the Planning Phase, the Work Plan and the Management Plan will be refined based upon findings. Particular attention will be paid to the refinement of the data collection task to be undertaken in the following phase. Also included in the revised Work Plan will be collection and analysis of data needed for the ranking process not already included in the Work Plan. The revised Work Plan and Management Plan will be submitted to MAG for approval.

Task 3.4 Task 3 Deliverable

The “Ranking Process Working Paper” documenting the steps undertaken in developing the ranking process and the ranking process itself will be prepared and submitted through MAG to the Steering Committee for review and comment following the process outlined at the beginning of the Work Plan.

Task 4. Collect Traffic Data – Aerial Photography

In this task, the OA team, specifically Skycomp, Inc., will develop freeway density and queue data through the shooting and evaluation of aerial photographs of the regional freeway system. Peak period flights will be flown between 6:00 a.m. and 9:00 a.m. (morning peak period) and 3:30 p.m. and 6:30 p.m. (afternoon peak period) on typical workdays (i.e. Tuesday, Wednesday, or Thursday) in September 2001.

Task 4.1. Aerial Photography

The freeway system will be divided into flight patterns (tours) such that a fixed-wing airplane can fly each tour in under one hour, returning to the start point within 60 minutes of beginning. During that hour, every foot of the freeway system will be photographed using time-stamped color photography. At the start of the next hour, the tour is repeated, and then repeated again during the third hour.

Flights covering each tour are then repeated during four morning and four evening survey periods; thus, with three-hour survey periods, each segment will be sampled a total of 12 times in the morning and 12 times in the evening. The start point of each flight is offset to the midpoint of the previous flight, so that when completed, each 30-minute time slice will hold two data samples from two different days.

Task 4.2. Data Processing

Data processing involves segmentation of the system and manual counts of the number of autos, trucks, tractor-trailers, tandem tractor-trailers, and buses in each segment (counts affected by verified incidents, etc. are also coded for later exclusion). Preliminary densities of traffic are then calculated and displayed by date and time slice. The results can then be compared from different days and time slices. A scrubbing process will then follow during which all density values "out-of-synch" with their neighbors are highlighted for scrutiny. This involves actually pulling out the underlying aerial photographs to verify each unexpected finding, and looking for apparent causes (such as incidents, road work, etc.). At this time additional codes, called “Z” codes can be added to the data, which will result in those values being excluded from the final averaged density values. Examples of Z codes are:

- z_i = incident;
- z_c = short-term construction or roadwork;
- z_r = "rubbernecking" (incident in opposite direction);
- z_u = unknown reason.

After the scrubbing process has been completed, final freeway density calculations are made and the data are packaged for delivery and analysis.

On- and off-ramps are treated as interrupted-flow facilities, with queue populations at bottlenecks (usually signals or ramp meters) determined as of the moment each photo was taken.

As part of this task, the number of traffic lanes for the freeway mainlines, on- and off-ramps, and freeway-to-freeway ramps will be documented as will turning movements permitted from each ramp lane.

Task 4.3. Data Presentation

Skycomp will prepare the following presentation materials:

1. Time-space density/LOS graphics for each highway
2. Examination of the underlying photography at all congested locations to determine and report the apparent causes of all existing freeway and ramp bottlenecks (with concurrent selection of illustrative highlight photography)
3. Production of an interactive CD-ROM slide-show containing one typical morning and one typical evening peak hour with an overlapping photographic pass of the entirety of each freeway
4. Production of a polished CD-ROM product containing the graphics discussed above, with links to the underlying highlight photography.

Descriptions of geographic locations in the databases will conform to those in the *Database Report of the MAG 1998 Regional Congestion Study*.

The following data requirements have been repeated from the RFP:

Freeway Density Counts:

- Excel spreadsheets describing parameters of the data collection, including flight date and time, encoding of time intervals, definition of freeway segments, and identification of freeway ramps.
- Freeway density 'raw data' database file to include information of flight number, route, direction, time, and vehicle classification counts.
- Average freeway density database by segment and by time slice, including information on number of lanes, freeway direction, and vehicle density every half hour during morning and afternoon peak periods;
- Photographic inventory of all the freeway sections where density data was taken, including a presentation showing location and duration of LOS F.

On- and Off-Ramp Queues:

- Each count will be identified by the freeway ramp identification and a date/time stamp.

- Database files will contain the raw queue data and average calculated queue for the peak periods by movement. The information will include the number of vehicles queued to make left turn, through, or right turn movements.
- For heavy weaving areas, the raw and calculated queue data will be by lane. The magnitude of the queues will also be shown graphically.
- Ramp metering rates will be documented for the time periods queue data were collected.

Task 5. Collect Traffic Data – Ground Counts

Under this task, the OA team, specifically ATD Northwest and Traffic Research & Analysis, will collect freeway traffic volume data via video and manual counting techniques. An attempt will be made to collect the video and manual count data on the same days the aerials are being flown. The two objectives of this task are:

- To have one representative 24-hour estimate of directional traffic volume on approximately every three miles of the freeway mainline
- To collect the data necessary to complete the ranking process

Task 5.1. Video Recording Counts

ATD Northwest will utilize the ADOT FMS video cameras to conduct this task. It is anticipated that four 5-minute samples per hour during peak periods and one 5-minute sample per hour during off-peak periods will provide sufficient data to estimate daily traffic volumes. Vehicle classification estimates will be made on mainline locations.

Task 5.2. Manual Traffic Counts

Where existing counts are not available and FMS camera coverage is not provided, 48-hour classification counts will be taken.

Task 5.3. Task 5 Deliverable

The Traffic Data Working Paper documenting all traffic count data obtained in this task will be prepared and submitted through MAG to the Steering Committee for review and comment following the process outlined at the beginning of the Work Plan.

As specified in the RFP, the raw and averaged counts database will include information of survey date, beginning and ending hour and minute, counts for each sample of the hour, etc. Corresponding samples from multiple days will be averaged to produce a single daily count database. Peak hour and daily traffic volumes will be shown graphically for both mainline and HOV lanes. Peak hour factors will be calculated.

Task 6. Identify and Analyze Problem Areas

Task 6.1. Bottleneck Area Analysis

The purpose of Task 6 is to identify and analyze the existing problem areas. The RFP lists the following seven locations that deserve special attention:

- Loop 202/I-10/SR 51 interchange
- Broadway Curve (I-10, US 60 to 48th Street)
- Loop 101 /Loop 202 interchange
- Loop 202 between SR 143 and Loop 101
- I-10/I-17 interchange near 23rd Ave
- I-10 between Loop 101 and I-17;
- SR 51 (HOV lane proposed)

Other locations that are not being improved through existing construction projects (e.g. the US 60 design/build project) will be identified through an evaluation of the data and discussions with the Steering Committee. All upstream and downstream points of the identified bottlenecks will be evaluated to identify hidden bottlenecks so that these points will also be considered in freeway improvement projects.

The analysis will be based upon one of the simulation models discussed in the Project Approach section of our proposal: HiCAP 2000, FREEVAL, or FREQ. The model choice will be based upon the factors necessary to complete the ranking process. Limitations and shortcomings of the different models will be considered, and documented, in the selection of the model to be used.

Task 6.2. Prepare Traffic Forecasts

The purpose of this task is to determine the potential impact of planned freeway construction on existing bottleneck locations and to identify potential future bottleneck locations. MAG will be responsible for coding and running MAG's travel forecast model for both ten- and twenty- year conditions. The OA team will review the model input with MAG prior to the assignments being run.

The future traffic forecasts will be used in the evaluation of identified bottleneck areas using the analysis technique determined to be the most effective in Task 6.1. Heavy weaving sections and other future problem areas will be identified through this analysis.

A final set of ten- and twenty- year traffic forecasts will be run based upon the improvements identified in this study.

Task 6.3. Task 6 Deliverable

The Bottleneck Analysis Working Paper documenting the methodology used and the results of the analysis will be prepared and submitted through MAG to the Steering Committee for review and comment following the process outlined at the beginning of the Work Plan. In addition, the input and output files of whichever software is used for the evaluation will be included in the deliverables.

Task 7. Propose Bottleneck Improvement Solutions

Task 7.1 Identify Improvements and Prepare Cost Estimates

The purpose of this task is to develop and prepare planning level cost estimates for potential solutions to identified bottleneck projects. Potential solutions, which will be included in this analysis include:

- Construction improvements such as mainline, auxiliary, or HOV lanes, ramp additions or improvements, and collector-distributor or frontage roads
- Operational improvements: such as ramp metering, signing and stripping

Planning level cost estimates will be prepared using ADOT data from similar projects.

Task 7.2. Task 7 Deliverable

The Proposed Improvements Working Paper documenting the identified improvements for the bottleneck area and a planning level cost estimate will be prepared and submitted through MAG to the Steering Committee for review and comment following the process outlined at the beginning of the Work Plan.

Task 8. Estimate Improvement Benefits

Task 8.1. Improvement Benefits

The purpose of this task is to quantify the benefits associated with each proposed bottleneck improvement project. The RFP states that MAG will work with the OA team to determine the best way to calculate travel benefits. Travel benefits will be evaluated from, but not limited to, the following aspects:

- Delay reduction
- VMT reduction
- Personal time savings
- Commercial vehicle time savings
- Safety savings
- Fuel savings
- Environmental savings
- Crash reduction
- Weaving

Task 8.2. Task 8 Deliverable

The Improvement Benefits Working Paper documenting the methodology used and the results of the improvement benefits estimation will be prepared and submitted through MAG to the Steering Committee for review and comment following the process outlined at the beginning of the Work Plan.

Task 9. Rank Projects

Task 9.1. Bottleneck Area Ranking and Cost/Benefit Rating

The purpose of Task 10 is twofold:

1. To rank the identified bottleneck areas based upon the ranking process defined in Task 3.1.
2. To rate the proposed bottleneck solutions using the cost/benefit data developed in Tasks 7 and 8.

The product of this task will be a ranking of the bottleneck areas identifying in what order improvements should be undertaken to address the most severe bottleneck areas. Attached to each ranked area will be a cost/benefit rating based upon the solutions identified by the OA team.

Task 9.2. Task 9 Deliverable

The results of the analysis will be presented in a working paper developed through the process discussed at the beginning of the Work Plan.

Task 10. Document Study Findings

Task 10.1 Draft Report

All of the edited working papers will be compiled into a draft report for submittal to MAG and the Steering Committee. One initial administrative draft in electronic and hard copy format for MAG review and 25 copies of the revised Draft Final Report with Executive Summary for distribution will be submitted.

Task 10.2. Final Report

Based upon comments received on the draft report, the final report will be prepared. One camera-ready original, one copy in electronic format and 100 bound copies of the full report with executive summary, plus 25 additional copies of the Executive Summary will be submitted.

The RFP contains a number of requirements for the final report and graphics. These are repeated below in Italics for future reference.

The study will be documented in a paper report and on a CD-ROM. The report will document the methodology and describe the findings. The CD-ROM will contain a detailed quantitative and pictorial inventory of freeway existing and future congestion conditions as well as relevant data. Aerial photos showing traffic conditions for all sections of freeway in the study area will be directly linked to diagrams illustrating the levels of service. All illustrations, sketches, and photos will be compatible with presentation software such as PowerPoint. Summaries of freeway segment and interchange data in the database will be linked to the photos.

Graphics will be presented showing the following information for morning and afternoon peak periods, for existing conditions, 2010 plan, 2020 plan; with and without improvements recommended by this study:

- *Peak hour traffic volumes for both general purpose lane and HOV lane;*

- *Peak hour LOS (existing conditions based on traffic density) for both general purpose lane and HOV lane;*
- *Duration of LOS F (existing conditions based on traffic density) for both general purpose lane and HOV lane;*
- *Length of queues on ramps*
- *Ramp traffic volume*

The following graphics for existing conditions only will be presented:

- *Truck volumes for morning and afternoon peak periods*
- *Weaving conditions for morning and afternoon peak periods*
- *Daily traffic volumes*
- *Daily truck volumes*
- *Number of existing lanes*
- *Existing improvement plans*
- *Number of currently planned lanes*
- *Peak Hour Factor for traffic count locations*

For each identified bottleneck, a graphic that shows number of lanes, weaving movement, future year traffic volume and LOS.

The following tables are identified as deliverables in the RFP:

- *Summary of the freeway level of services and hourly flow rate*
- *Listing of freeway bottlenecks based on existing traffic*
- *Listing of freeway bottlenecks based on future traffic*

Suggested actions for the freeway bottlenecks, including demand, benefits, costs, and the cost/benefit ratio for each project

The Tasks 11, 12, 13, 14, 15, 16 were added to the original Scope of Work.

Task 11. Safety Review of the Urban Freeway System

The purpose of this task is to perform a safety review of the urban freeway system. This will include the identification of crash patterns on the freeway system that may be contributing to the bottleneck phenomenon and to suggest possible measures for reducing crashes.

Task 11.1 Literature Research

A literature search will be conducted to identify three major metropolitan areas that have conducted freeway safety evaluation. The locations will be selected through consultation with MAG and FHWA. Reports prepared by these three agencies will be reviewed to determine countermeasures that have been identified by others to deal with crash patterns that may be encountered in the MAG region.

Task 11.2 Data Collection

A considerable amount of traffic data—volumes, counts, queues, etc.—will be collected for the identification, analysis, and prioritization of bottleneck locations, the exact extents of which will be determined and documented in the Data Collection Plan. It is anticipated that additional data will be required to complete the crash analysis spelled out in this task and the freeway capacity evaluation of the next task. Therefore a sum of money has been reserved for collection of this data. The exact data to be collected and the cost for collection will be documented in the Data Collection Plan and submitted for approval by MAG.

For all the data collected, quality control checks should be made. These checks will search for inconsistencies or unusually large variations between time intervals, and identify the locations where the counts appeared questionable. The quality control checks include, but are not limited to, conducting manual checks after the data for each count is downloaded and printed out, using a count viewer program that graphs the volume by 15-minute interval, to look for inconsistencies between the same time periods of different days, and checking the consistencies and reasonableness of volumes along the traffic flow, etc. After the checks are made, any data that are identified as being inconsistent with overall travel patterns or otherwise “suspicious” should be cropped out – provided that at least 24 consecutive hours of “good” data still remain after the deletion. If this is not the case, the count should be dropped or redone with the new data replacing the questionable data in the databases. After these checks are made, “Clean” databases containing the good data of all locations will be generated and submitted to MAG.

Task 11.3 Crash Analysis

Crashes occurring in the three-year period from January 1, 1998 through December 31, 2000 that have been entered into the ADOT Accident Records System will be used in the analysis. Data including the location, frequency, severity, and type of crashes that have occurred during these years will be compiled. The data will be evaluated in one-year increments to provide comparable data for freeways that have been opened for less than one year, and also to eliminate anomalies caused by freeway reconstruction. A record of major improvements or extended construction activities carried out on the system during the study period will be documented (for example, the installation of the median cable barriers on SR-51 and the I-17 widening project). An analysis will be performed to provide insight into contributing causes of crashes. The OA team will plot crash locations by type of accident and will compute crash rates for one-mile segments centered on the interchanges (where interchange spacing is greater than one mile, the crash data will be summarized for the segment between interchange-centered segments). For each one-mile segment, crash frequencies, rates, types, contributing factors, and severity will be identified. A working paper documenting the crash analysis will be prepared and submitted through MAG to the Stakeholders Group for review and comment following the process outlined at the beginning of the Work Plan.

Task 11.4 Review of Urban Freeway Crash Data Analysis

The draft results of the crash analysis will be provided to the MAG project Stakeholders Group for review and comment. The results from the analysis will be reviewed with the project Stakeholders Group and member agencies and, if appropriate, potential countermeasures to the crash problem will be identified.

Task 11.5 Crash Analysis Documentation

The results of the analysis and evaluation will be documented and submitted through MAG to the Stakeholders Group for review and comment following the process outlined at the beginning of the Work Plan. The crash analysis will be incorporated into the Regional Freeway Bottleneck Study final report.

Task 12. Interchange Spacing Study

The freeway system in the MAG region has been developed with traffic interchanges located at most section line road locations. At many locations where interchanges have not been provided, the local jurisdictions have requested, or are considering requesting, that one be constructed. The purpose of this task is to evaluate the traffic impacts of interchange spacing. To accomplish this, traffic flow in areas where interchanges are not provided at every mile will be assessed on both the freeway and on the arterial street system.

The results of this analysis will not result in the approval of new traffic interchanges. A Change of Access Report for each individual interchange will need to be prepared and approved by ADOT and/or the FHWA and funding will have to be identified before a new interchange can be constructed.

Task 12.1 Evaluate Traffic Circulation Impacts

The MAG traffic forecast model and planned 2020 network would be used to assess the impact of additional interchanges on the freeway and arterial street system (generally at one-mile spacing). Three test areas will be used in the evaluation: I-10 from Jackrabbit Trail to Litchfield Road, US-60 from Stapley Drive to Greenfield Road, and I-17 from Happy Valley Road to Anthem Way. The base case for the evaluation will be as-is conditions. The test case will add interchanges where future arterial streets are planned to cross or intersect the freeway (generally at one-mile spacing) in the I-10, US-60, and I-17 corridors. The socioeconomic data in the study areas will be reviewed prior to preparing the assignments.

The potential traffic impacts of the additional interchanges will be determined on the freeway, on parallel arterial streets, and on arterial streets crossing or intersecting the freeway with and without the additional interchanges. Parallel streets within two miles of the freeway, or if there are none within two miles, the nearest parallel arterial street, will be considered in the analysis. Arterial streets intersecting or crossing the freeway within one mile of either end of the test freeway section will also be included.

The analysis will consist of comparing the total vehicle miles and vehicles hours of travel on the freeway and arterial streets, comparing volumes on links of the arterial street system, and determining potential travel time and distance savings to users through a SELINK analysis.

In addition, an analysis of the freeway itself will be conducted in order to determine the impact of the additional interchanges on freeway operations. Such an analysis will employ the prescribed methodologies of the 2000 Highway Capacity Manual.

Task 12.2 Interchange Spacing Documentation

The results of the evaluation will be documented and submitted through MAG to the Stakeholders Group for review and comment following the process outlined at the beginning of the Work Plan. The Interchange Spacing Study will be submitted to MAG as a stand-alone report.

Task 13. Freeway Capacity Enhancement

The purpose of this task is to document innovative approaches for expansion of urban highway capacity in present or planned use throughout the world today. It is anticipated that the ideas tested will range from the tried and true, to the experimental, to the conceptual. Any concepts that would result in traffic flows of LOS D (2020 traffic volumes) or better will be considered. Constraints and impacts such as right-of-way, environmental impacts, construction costs, and construct ability will be addressed.

Task 13.1 Research Capacity Increase Projects

A national/international literature search will be undertaken to identify freeway capacity enhancement projects that have been opened to traffic or are in the planning/design/construction phase. The focus of this effort will be to identify methods of increasing corridor capacity (or efficiency) when opportunities to add new right-of-way are limited. These methods include but are not limited to double decking, cantilevers, express lanes, HOV lanes, HOT lanes, road pricing, tunneling, cut and cover, separating cars from large vehicles on the same facility, automated highways, ITS methods, etc. Some of the concepts that will be included have already been printed in a 1999 white paper developed by the Reason Institute, “How to Build Our Way Out of Congestion”. It is anticipated that the methods identified in that white paper will be updated to include any “current” capacity increase project or concept, national or international, so that MAG is informed of and fully understands any practice or methodology that may possibly be used to resolve bottleneck problems.

Task 13.2 Document Capacity Increase Projects

The results of the capacity increase research will be submitted through MAG to the Stakeholders Group for review and comment following the process outlined at the beginning of the Work Plan. The results will then be documented in a stand-alone report and summarized in the full freeway capacity report. A PowerPoint presentation showing the results of the research will also be prepared.

Task 14. Future Freeway Demand

The purpose of this task is to determine the demand on regional freeway corridors in future years. The corridors to be evaluated will include:

- I-10 from SR-85 to Riggs Road
- I-17 from the I-17/I-10 interchange near 24th Street to New River Road
- SR-51 from the I-10/SR-51 interchange to Loop 101
- US-60 from the I-10/US-60 interchange to Mountain View Road
- US-60 (Grand Avenue) from Loop 101 to I-17
- All of Loop 101
- All of SR 143
- All of Loop 202
- All of Loop 303

Task 14.1 Determine Freeway Demand

To determine freeway demand, a year 2025 unrestrained traffic assignment will be requested from MAG for the existing and planned freeways. The basic number of mainline and ramp lanes that would be required to accommodate the future freeway demand at a peak hour LOS D will be determined using methodologies from the 2000 Highway Capacity Manual; after which, a restrained traffic assignment will be run. If freeway volumes exceed capacity with the restrained assignment, additional capacity will be added and the restrained assignment will be repeated. This process will be repeated until the freeway volumes are such that peak hour LOS D is attained generally on the freeway system.

Starting with the final 2025 network, the same procedure will be followed for the year 2040 with a goal of determining the freeway system necessary to maintain peak hour LOS D through 2040.

Mainline and ramp volumes will be then determined and presented on a traffic volume map for both 2025 and 2040. In addition, vehicle-miles of travel (VMT) and vehicle hours of travel (VHT) on the freeway system and the arterial street system will be compared to existing and 2025 (under the current plan) VMT and VHT.

Task 14.2 Identify Capacity Deficient Corridors

The purpose of this task will be define segments of the study corridors where the capacity will be significantly exceeded and innovative capacity enhancement techniques will need to be considered. “Significantly exceeds capacity” may be defined as a condition where the forecast volume exceeds the Level of Service D service volume of a ten-lane freeway. The final definition will be determined by MAG through discussion with the Stakeholders Group.

Task 14.3 Incorporate Transit Considerations

Consulting with RPTA, MAG staff, and the High Capacity Transit Study consultants, a discussion of the role that transit could play in the freeway corridors will be prepared. This discussion will be included in the final report.

Task 14.4 Document Freeway Demand

The results of the freeway demand task will be documented and submitted through MAG to the Stakeholders Group for review and comment following the process outlined at the beginning of the Work Plan. Included in the working paper will be a list of those freeway segments that significantly exceed capacity and thus will be further evaluated in the next task.

Task 15. Identify and Evaluate Alternate Freeway Concepts

The purpose of this task is to define a freeway system, consisting of only existing and planned corridors, which would carry peak hour traffic at LOS D or better into the future. For purposes of this study, financial, environmental, and socioeconomic constraints will be ignored.

Task 15.1 Identify Alternate Concepts

Alternative concepts to accommodate the basic lane requirements will be identified. A brainstorming session, with all interested and affected parties invited to participate, will be held as part of the concept definition effort. The concepts will include, but not be limited to, widening, double decking, tunnels, reversible lanes, vehicle-only lanes, truck lanes, express lanes, collector-distributor roads, HOV lanes, toll lanes, HOT lanes, interchange reconfiguration, vehicle-highway automation, etc. The capacity increase research will provide considerable input into this concept identification.

Up to five concepts per corridor will be fully defined, both verbally and pictorially, and submitted through MAG to the Stakeholders Group for review and comment following the process outlined at the beginning of the Work Plan.

Task 15.2 Analyze Alternate Configurations

The identified configurations will then be analyzed. The analysis will include an evaluation of the entire system, including intersections associated with arterial street interchanges. Methodologies included in the 2000 Highway Capacity Manual will be used in the analysis. A more detailed HCM analysis will be conducted at the seventeen existing and future system interchange locations:

- I-10/101L
- I-10/202L (59th Avenue)
- I-10/I-17 (23rd Avenue)
- I-10/SR 51/101L
- I-10/I-17 (20th Street)
- I-10/SR 153/SR 143
- I-10/US 60

- I-10/202L (Pecos Road)
- I-17/101L
- US 60/101L
- US 60/202L
- 101L/SR 51
- 202 I/SR 143
- 101L/202L (Salt River)
- 101L/202L (Pecos Road)
- 101L/US-60 (Grand Avenue)
- I-17/US-60 (Grand Avenue)

A traffic assignment with Grand Avenue coded as a freeway will be prepared to evaluate its impact. The forecast volumes on other freeways with and without a Grand Avenue Freeway will be compared to see if the new freeway would result in significant improvements.

The configurations will be evaluated using operational characteristics such as delay reduction. As part of this analysis, MAG will be asked to run an air quality analysis comparing conditions in 2025 and 2040 with the currently planned system and the preferred configuration.

The results of the analysis will be submitted through MAG to the Stakeholders Group for review and comment following the process outlined at the beginning of the Work Plan.

Task 15.3 Prepare Cost Estimates

The evaluation of the configurations will include a planning level cost estimate and an estimate of additional right-of-way requirements.

Cost estimates for the projects found in the capacity enhancement research and ongoing freeway construction projects, will provide input into the estimated costs. In addition, ADOT personnel involved in freeway construction project funding will be consulted to aid in identifying cost factors that should be included in the estimates and also to provide a reasonableness check of preliminary cost estimates.

Additional right-of-way requirements will be estimated for each freeway corridor. This will be done by determining the acreage of right-of-way required for the preferred configuration, and subtracting the existing right-of-way acreage. Maps showing additional right-of-way will not be prepared since this study will not go into sufficient detail to determine which side of existing right-of-way should be used for widening. However, an estimate of the number of buildings that would need to be acquired will be made.

Task 15.4 Prepare Evaluation Working Paper

The results of the evaluation will be submitted through MAG to the Stakeholders Group for review and comment following the process outlined at the beginning of the Work Plan.

Task 16. Capacity Enhancement Report

The process and results of the freeway enhancement evaluation conducted in Tasks 14 and 15 will be documented and submitted through MAG to the Stakeholders Group for review and comment following the process outlined at the beginning of the Work Plan. The report will include a description of the alternatives, the advantages and disadvantages of each alternative, areas of conflict and of agreement, and identification of the alternatives that have the greatest potential for success in accomplishing major objectives and achieving public acceptance. A discussion of the population growth projected for the region will be included in the introductory material to the report.